



REPLY TO  
ATTENTION OF

DEPARTMENT OF THE ARMY  
GALVESTON DISTRICT, CORPS OF ENGINEERS  
P. O. BOX 1229  
GALVESTON, TEXAS 77553-1229

FEB - 1 2013

January 28, 2013

Environmental Section

Jane B. Watson, Ph.D.  
Associate Director  
Ecosystems Protection Branch  
U.S. Environmental Protection Agency  
1445 Ross Avenue, Suite 1200  
Region VI, Mail Code 6WQE  
Dallas, Texas 75202-2733

Dear Dr. Watson:

Reference is made to documents entitled *Houston - Galveston Navigation Channels, Texas Limited Reevaluation Report and Final Supplemental Environmental Impact Statement* dated November 1995, describing our proposed discharge plan for maintenance dredging of the Federal Navigation Project, Houston - Galveston Navigation Channels (HGNC), Texas.

This is to notify you that maintenance dredging is planned to remove restrictive shoals from the Houston Ship Channel - Carpenter Bayou to and including Greens Bayou. Dredging is scheduled to commence in August 2013, and will take approximately 120 days to complete. The work duration will depend on the exercise of the contract options. The work will be performed by contract pipeline dredge between station numbers 570+00 and 886+00. This contract specifies dredging about 1,000,000 cubic yards (CY) of dredged material if all of the options are awarded. The Lost Lake and Clinton upland confined placement areas will be utilized for dredged material discharge operations. Plans and specifications for this job are not yet available; however, a set of plans from the previous dredging contract has been included for your review.

Water, elutriate, and sediment samples were collected and underwent chemical analyses. Samples were analyzed for the standard list of contaminants of concern with the addition of dioxins and furans. The enclosed tables contain data on detected analytes, only. The complete list of contaminants analyzed, and data sheets containing field-collected data and sample locations are also enclosed.

Please see the attached report for data and a summary of findings. All water and elutriate samples were below applicable EPA Water Quality Criteria. The sediment quality data are based on analyses of composite samples comprised of subsamples collected perpendicular to the centerline of the channel. There are no EPA quality criteria for sediments. A comparison with sediment quality screening guidelines indicates that unacceptable adverse impacts would not result from dredging and discharge operations.

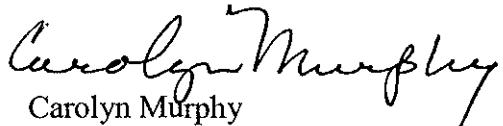
Total Toxic Equivalency Quotients (TEQs) for dioxin and furans were calculated for all samples. Calculated TEQs for sediment ranged from 14 ppt to 54 ppt. While this is slightly

higher than Houston Ship Channel and Galveston Channel recently, it does reflect the low level dioxin/furan contamination that is ubiquitous in environmental media throughout the United States including coastal areas.

We have reviewed and interpreted information in the 2009 permit conditions for the Area of Concern for the San Jacinto River Waste Pits Superfund Site as recommended by EPA. Although the material is not originating from within the area of concern, Lost Lake disposal area is within its geographical limits. The permit conditions specify that material tested with TEQs at between 0.45 ppt and 1000 ppt can be placed in upland confined disposal area. As such, the current contract placement at Lost Lake is appropriate.

Additionally, historical data previously provided to you indicate that no unacceptable adverse impacts are expected to occur from the dredging and discharge operations. Should you need additional information or have any questions concerning the proposed operations, please call Ms. Lisa Finn at (409) 766-3949.

Sincerely,



Carolyn Murphy  
Chief, Environmental Section

Encls

CF:

U.S. Fish and Wildlife Service  
17629 El Camino Real, Suite 211  
Houston, Texas 77058

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National Marine Fisheries Service  
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TCEQ-MC150  
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✓Ms. Karen McCormick, Chief  
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1445 Ross Avenue  
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Mr. Stephen Tzhone  
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CF: w/o Encl:  
CESWG-OD-N

26 December 2012

Ms. Lisa M. Finn  
U.S. Army Corps of Engineers  
Environmental Section  
P.O. Box 1229  
Galveston, TX 77553-1229

Re: Contract W912HY-11-D-003, Task Order 0012.

Dear Ms. Finn,

SOL Engineering, A&B Labs, Test America, and Atkins ("The SOL Team") were contracted by the U.S. Army Engineer District, Galveston, to provide assistance with the sampling, analysis, and reporting for the maintenance dredging the Houston Ship Channel (HSC), Carpenters Bayou to Greens Bayou to comply with requirements of the Clean Water Act. The lead review agency for this project is the U.S. Environmental Protection Agency (EPA), Region 6, Dallas, Texas. This project was completed under Contract W912HY-11-D-003, Task Order (TO) 0012.

Please consider this draft letter report as partially satisfying the requirements of the above noted TO. After the Galveston District Review, we will make necessary modification to the letter report and submit a final letter report, plus a hard copy and a CD containing all raw chemistry data, Water Quality Data sheets, and Excel and Word files, as required by the TO.

#### METHODS

All sampling stations (Attachment A) noted in the Sampling and Analysis Plan (SAP) attached to TO 0012 for the HSC, Carpenters Bayou to Greens Bayou Project (Attachment B) have been collected according to the requirements of the SAP by Atkins .

All chemical analyses were performed by A&B Labs (with subcontracts to Summit Environmental Technologies, Inc. and Accutest Laboratories), Houston, TX, except for the dioxin and furan analyses, which were performed by Test America, Knoxville, TN. All chemical analysis required by TO012 have been completed according to the SAP.

#### RESULTS

The water quality parameters taken at the time of collection are presented in Table 1 (Attachment C), as are the coordinates at which samples were collected. Included in Tables 2 – 5 (Attachment C) are a list of the parameters for which analysis was required under the TO and the concentrations of

detected parameters in the various media. Also included in the tables are appropriate standards, criteria, or screening values to which the detected parameters can be compared.

There are a few consistent trends in the standard parameter data (see Table 1). Salinity is highest at Station H-MC-12-11 and decreases as the stations go up the HSC, especially dropping off at the Greens Bayou stations. Dissolved oxygen is good at all stations, barely dropping below 6 ppm. Air and water temperature vary, as would be expected, with the time of day.

The results of chemical analyses for compounds detected in water and elutriate samples are presented in tables 3 and 4. Also included in tables 3 and 4 are the Texas Surface Water Quality Standards (TWQS), provided by the Texas Commission on Environmental Quality (TCEQ) for the protection of aquatic life. Since the sediment and water samples used to prepare the elutriates are from grab samples from a marine environment, and thus are a snap shot in time, not from a series of samples taken over time, e.g., a 7-day average like chronic TWQS, the acute marine TWQS are more appropriate for comparison. An examination of Table 3 indicates that there are no exceedances of any acute TWQS for the Channel stations.

Elutriates were prepared from test sediment and channel water, filtered to remove suspended material for trace metal analysis (except mercury and selenium) or centrifuged, and submitted for chemical analysis. Therefore, the elutriate provides information on those constituents that are dissolved into the water column during dredging and open-water placement. A comparison of the elutriate results with the channel water results indicates apparent increases in arsenic, ammonia, , total cyanide, and total TEQ concentrations and apparent decreases in copper and zinc concentration upon elutriate preparation. The other constituents either were not detected often enough to suggest a trend, there was essentially no change, or the changes varied in directionality. An examination of Table 4 indicates that there are no exceedances of any acute TWQS by the elutriates from the Channel stations.

Sediment concentrations of detected compounds are presented in Table 5. Concentrations of metals tended to be highest at Stations H-G-12-01 or H-G-12-01B, while polycyclic aromatic hydrocarbons (PAHs) were found only in the Greens Bayou stations, except for a few at Station H-GC-12-05 and its duplicate. All of the stations were fine grained, with a maximum sand/gravel concentration of 20.3%, so looking for trends based on fines concentrations is unproductive. However, the variation in the metals concentrations was not large.

There are no enforceable sediment quality criteria or standards with which to compare concentrations in the sediment. However, there are several different guidelines that are used to look for a cause for concern in sediment samples, one of which is the Effects Range Low, or ERL. Several ERLs were exceeded: copper (at one station at 44.9 mg/kg vs the ERL of 34.0 mg/kg); mercury (at six stations, ranging from 0.151 to 0.190 mg/kg vs the ERL of 0.15 mg/kg); acenaphthene, fluorene, and phenanthrene (at Station H-G-12-01B at 111, 103, and 526 µg/kg vs ERLs of 16, 19, and 240 µg/kg, respectively). The Effect Range Mediums (ERMs) for copper is 270

mg/kg, mercury is 0.71 mg/kg., acenaphthene is 500 µg/kg, fluorene is 540, and phenanthrene is 1500, well above the values noted above for the metals and the PAHs.

Dioxin and furan analyses on sediment samples were conducted and the results, both raw data and data normalized to total organic content of the individual sediments, are included in Table 5. The range of values, 14 to 54 picograms/gram (pg/g or parts per trillion) dry weight total Toxic Equivalent of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TEQ), is slightly higher than Houston Ship Channel and Galveston Channel recently (0.5 pg/g to 5.4 pg/g), which were considered not to "reflect significant point source contributions of dioxins/furans to the project area but rather reflect the low level dioxin/furan contamination that is ubiquitous in environmental media throughout the United States, including coastal areas " [Statement of Finding for Galveston Harbor and Channel and Houston Ship Channel Dredging Project, 10 January 2012]. However, the present concentrations are similar to those found in the Florida Panhandle Bays (0.51 to 77.51 pg/g, Hemming et al, 2002), Detroit/Rouge Rivers (3-62 pg/g, Kannan et al., 2001, in Hemming et al, 2002) and less than that found in Lake Ontario (68-500 pg/g, U.S. EPA, 1993, in Hemming et al, 2002) and Newark Bay (730-7600 pg/g, U.S. EPA, 1993, in Hemming et al, 2002). Therefore, it would appear that the values found in the present project also "...reflect the low level dioxin/furan contamination that is ubiquitous in environmental media throughout the United States, including coastal areas."

There is nothing in the chemical analyses that would indicate a concern with the placement of these sediments, under the guidance provided by the RIA and/or the Inland Testing Manual.

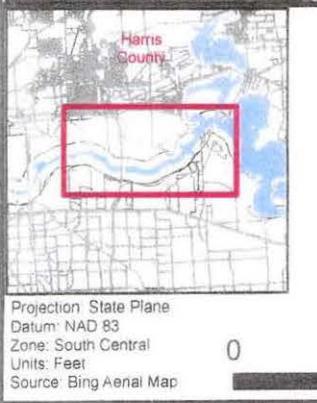
Sincerely,

Martin Arhelger for:

Derek Starling, P.E., C.Q.E.  
Principal  
SOL Engineering Services, LLC

## **Literature Cited**

- Buchman, M.F. 2008. NOAA Screening Quick Reference Tables. NOAA OR&R Report 08-1. Seattle, Washington. Office of Response and Restoration Division. National Oceanic and Atmospheric Administration, 34 pp.
- Hemming, J.M., M.S. Brim, R.B. Jarvis. 2002. Survey of Dioxin and Furan Compounds in Sediments of Florida Panhandle Bay Systems. U.S. Fish and Wildlife Service Publication No. PCFO-EC 02-01.
- Kannan, K., J.L. Kolber, Y.S. Kang, S. Masunaga, J. Nakanishi, A. Ostaszewski, J.P. Giesy. 2001. Polychlorinated naphthalenes, biphenyls, dibenzo-p-dioxins, and dibenzofurans as well as polycyclic aromatic hydrocarbons and alkylphenols in sediment from the Detroit and Rouge Rivers, Michigan, USA. Environmental Toxicology and Chemistry 20(9), 1878-1889.
- U.S. Environmental Protection Agency. 1993. Interim Reports on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risk to Aquatic Life and Associated Wildlife. EPA/600/R93/055.



● Sampling Location



106 South President Street, Suite 400  
Jackson, Mississippi 39201  
Phone: (601) 961-1415  
Fax: (601) 960-0420

**Figure 1**  
**Sampling and Chemical Analysis**  
**HSC - Carpenters Bayou**  
**to Greens Bayou**  
**Harris County, Texas**

Prepared By: SOL	Scale: 1" = 1.0 miles
Job No: 1120	Date: 11/02/2012
File: S:\GIS\Carpenter Bayou\Figure 1 - CB Sampling.mxd	

## **ATTACHMENT C - TABLES**

TABLE 1  
STANDARD PARAMETERS  
HSC - Carpenters Bayou to Greens Bayou

Station*	Date	Time	Channel Station	Water	Dissolved	Salinity (%)	Water	Air	Coordinates			
				Depth (ft)	Oxygen (mg/L)		pH	Temp (°C)	Temp (°C)	Deg.	Latitude (N) Min.	Longitude (W) Min.
H-MC-12- 11A	10/30/2012	1040	500+00	51	6.50	7.72	19.32	19.2	17.8	29	45 41.3	95 5 17.2
H-MC-12- 11B	10/30/2012	1100	500+00	52	6.49	7.71	19.27	19.2	17.8	29	45 45.1	95 5 20.9
H-CG-12- 01A	10/30/2012	1125	550+00	51	6.57	7.71	18.22	19.2	18.9	29	45 0.3	95 5 47.3
H-CG-12- 01B	10/30/2012	1135	550+00	49	6.62	7.67	18.22	19.7	19.4	29	45 2.8	95 5 51.6
H-CG-12- 02A	10/30/2012	1146	600+00	49	6.34	7.60	17.07	19.7	19.4	29	44 27.7	95 6 31.0
H-CG-12- 02B	10/30/2012	1154	600+00	49	6.20	7.60	17.17	19.7	19.4	29	44 30.7	95 6 32.5
H-CG-12- 03	10/30/2012	1213	650+00	50	6.20	7.61	17.18	20.0	20.0	29	44 5.2	95 7 21.4
H-CG-12- 04A	10/30/2012	1235	700+00	48	5.88	7.56	16.29	20.1	20.6	29	44 5.2	95 8 18.4
H-CG-12- 04B	10/30/2012	1255	700+00	48	5.87	7.55	16.28	20.1	21.1	29	44 7.7	95 8 18.1
H-CG-12- 05A	10/30/2012	1410	750+00	44	6.35	7.58	16.04	20.4	22.8	29	44 15.4	95 9 13.6
H-CG-12- 05B	10/30/2012	1425	750+00	44	6.26	7.57	16.30	20.2	22.8	29	44 16.5	95 9 13.0
H-CG-12- 06A	10/30/2012	1450	800+00	48	6.00	7.54	15.94	20.3	21.7	29	44 43.6	95 9 59.2
H-CG-12- 06B	10/30/2012	1500	800+00	49	6.00	7.54	15.91	20.4	21.7	29	44 45.9	95 9 58.2
H-G-12- 01AA	10/30/2012	1537	5+00	45	6.50	7.54	15.74	20.4	21.7	29	44 51.2	95 10 7.0
H-G-12- 01AB	10/30/2012	1525	5+00	45	6.52	7.55	15.73	20.4	21.7	29	44 50.0	95 10 5.7
H-G-12- 01AC	10/30/2012	1515	5+00	45	6.94	7.54	16.18	20.2	21.7	29	44 48.8	95 10 4.5
H-G-12- 01A	10/30/2012	1549	10+00	44	7.22	7.54	13.77	20.3	21.1	29	44 54.9	95 10 3.2
H-G-12- 01B	10/30/2012	1545	10+00	44	7.23	7.53	13.86	20.3	21.7	29	44 54.0	95 10 2.2
H-G-12- 01BA	10/30/2012	1600	15+00	46	5.82	7.53	14.55	20.2	21.7	29	44 58.2	95 9 59.0
H-G-12- 01BB	10/30/2012	1608	15+00	47	5.75	7.53	14.57	20.2	21.7	29	44 57.8	95 9 58.5
H-G-12- 01BC	10/30/2012	1614	15+00	46	5.76	7.53	14.53	20.2	21.7	29	44 57.3	95 9 58.0
H-G-12- 02	10/30/2012	1639	50+00	25	5.83	7.50	12.45	20.2	21.1	29	45 10.1	95 10 20.0
H-G-12- 02SA	10/30/2012	1700	80+00	18	6.18	7.53	10.60	20.3	20.6	29	45 26.7	95 10 45.5
H-G-12- 02SB	10/30/2012	1650	80+00	20	6.21	7.50	10.27	20.3	21.1	29	45 26.9	95 10 45.2
H-G-12- 02SC	10/30/2012	1655	80+00	19	6.20	7.52	10.28	20.3	20.6	29	45 27.1	95 10 44.8

H-MC-12-11 = DUP 1; H-CG-12-05 = DUP 2.

TABLE 2  
PARAMETERS DETERMINED BY CHEMICAL ANALYSIS

<u>METALS</u>	
Antimony	Lead
Arsenic	Mercury
Beryllium	Nickel
Cadmium	Selenium
Chromium, Total	Silver
Chromium, Trivalent	Thallium
Chromium, Hexavalent	Zinc
Copper	
<u>PESTICIDES AND PCBs</u>	
Aldrin	Dieldrin
Alpha-BHC	Endosulfan I
Beta-BHC	Endosulfan II
Gamma-BHC (Lindane)	Endosulfan sulfate
Delta-BHC	Endrin
Chlordane	Endrin aldehyde
Alpha-Chlordane	Heptachlor
Gamma- Chlordane	Heptachlor epoxide
4,4'-DDD	Toxaphene
4,4'-DDE	Total PCBs
4,4'-DDT	
<u>SEMIVOLATILES</u>	
Acenaphthene	Dimethyl phthalate
Acenaphthylene	Di-n-butyl phthalate
Anthracene	2,4-Dinitrotoluene
Benzidine	2,6-Dinitrotoluene
Benzo(a)anthracene	Di-n-octyl phthalate
Benzo(a)pyrene	1,2-Diphenylhydrazine
Benzo(ghi)perylene	Fluoranthene
Benzo(b&k)fluoranthene	Fluorene
Bis(2-chloroethoxy)methane	Hexachlorobenzene
Bis(2-chloroethyl)ether	Hexachlorobutadiene
Bis(2-chloroisopropyl)ether	Hexachlorocyclopentadiene
Bis(2-ethylhexyl)phthalate	Hexachloroethane
4-Bromophenyl phenyl ether	Indeno(123-CD)pyrene
Butyl benzyl phthalate	Isophorone
4-chloro-3-methylphenol	2-Methyl-4,6-dinitrophenol (4,6-dinitro-o-cresol)
2-Chloronaphthalene	Naphthalene
2-Chlorophenol	Nitrobenzene
4-Chlorophenyl phenyl ether	2-Nitrophenol
Chrysene	4-Nitrophenol
Dibenzo(ah)anthracene	N-nitrosodimethylamine
1,2-Dichlorobenzene	N-nitrosodi-n-propylamine
1,3-Dichlorobenzene	N-nitrosodiphenylamine
1,4-Dichlorobenzene	Phenanthrene
3,3'-Dichlorobenzidine	Phenol
2,4-Dichlorophenol	Pentachlorophenol
2,4-Dinitrophenol	Pryene
Diethyl phthalate	1,2,4-Trichlorobenzene

2,4-Dimethylphenol

2,4,6-Trichlorophenol

TABLE 2 (Concluded)

PARAMETERS DETERMINED BY CHEMICAL ANALYSIS

CONVENTIONAL PARAMETERS

Ammonia	Total Petroleum Hydrocarbons
Cyanide	% Solids*
Total Organic Carbon	

DIOXIN/FURAN CONGENERS

2,3,7,8 - Tetrachloro Dibenzo-p-Dioxin	1,2,3,7,8,9 - Hexachloro Dibenzo-p-Dioxin
1,2,3,7,8 - Pentachloro Dibenzo-p-Dioxin	1,2,3,4,6,7,8 - Heptachloro Dibenzo-p-Dioxin
1,2,3,4,7,8 - Hexachloro Dibenzo-p-Dioxin	Octachloro Dibenzo-p-Dioxin
1,2,3,6,7,8 - Hexachloro Dibenzo-p-Dioxin	
2,3,7,8 - Tetrachloro Dibenzo-p-Furan	2,3,4,6,7,8 - Hexachloro Dibenzo-p-Furan
1,2,3,7,8 - Pentachloro Dibenzo-p-Furan	1,2,3,7,8,9 - Hexachloro Dibenzo-p-Furan
2,3,4,7,8 - Pentachloro Dibenzo-p-Furan	1,2,3,4,6,7,8 - Heptachloro Dibenzo-p-Furan
1,2,3,4,7,8 - Hexachloro Dibenzo-p-Furan	1,2,3,4,7,8,9 - Heptachloro Dibenzo-p-Furan
1,2,3,6,7,8 - Hexachloro Dibenzo-p-Furan	Octachloro Dibenzo-p-Furan

\* sediment only

TABLE 3  
CONCENTRATIONS OF DETECTED COMPOUNDS (ug/L)  
WATER  
HSC - Carpenters Bayou to Greens Bayou

Date Sampled: October 30, 2012

Parameter	WQS**		Contract Required Detection Limit	Reporting Limit	H-MC-12		H-GC-12						H-G-12					
	Acute	11			11 Dup		01	02	03	04	05	05 Dup	06	01A	01	01B	02	02S
Antimony	N/A	3	5.00	0.90	J	0.60	J	0.80	J	0.70	J	0.70	J	0.90	J	0.70	J	0.60
Arsenic	149	1	5.00	3.50	J	2.50	J	3.20	J	3.10	J	3.20	J	3.30	J	3.20	J	3.00
Chromium, Total	N/A	1	5.00	0.522	J	BDL	J	1.32	J	BDL	J	BDL	J	BDL	J	0.580	J	0.582
Copper	13.5	1	5.00	2.90	J	2.50	J	2.60	J	3.00	J	2.30	J	2.30	J	2.60	J	2.50
Lead	133	1	5.00	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL
Nickel	118	1	5.00	2.10	J	1.90	J	1.90	J	2.10	J	2.40	J	2.20	J	2.60	J	2.90
Selenium	564	2	5.00	0.866	J	0.924	J	0.779	J	1.10	J	1.93	J	0.694	J	0.516	J	0.693
Zinc	92.7	1	20.00	26.5		20.3		23.5		22.6		25.5		25.3		29.7		23.8
Ammonia*	N/A	0.07	0.50	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL
TOC (%)	N/A	0.10	1.00	5.2		4.8		4.8		5.2		8.6		7.3		6.7		5.1
Total Cyanide	N/A	0.10	1.00	4.4		4.8		5.8		3.8		4.2		4.0		6.2		6.0
<b>UN-NORMALIZED DATA as TEQs***</b>																		
2,3,7,8-TCDD	N/A		0.270	0.130		0.310		0.200		0.340 QJ		0.160		0.500 QJ		0.390 QJ		0.180
1,2,3,7,8-PeCDD	N/A		0.130	0.110		0.150		0.150		0.130		0.130		0.090		0.090		0.100
1,2,3,4,7,8-HxCDD	N/A		0.016	0.015		0.014		0.017		0.014		0.018		0.013		0.013		0.014
1,2,3,6,7,8-HxCDD	N/A		0.018	0.016		0.015		0.077 QJ		0.015		0.020		0.014		0.014		0.015
1,2,3,7,8,9-HxCDD	N/A		0.016	0.014		0.014		0.016		0.014		0.018		0.013		0.014		0.018
1,2,3,4,6,7,8-HpCDD	N/A		0.032 BJ	0.041 BJ		0.030 BJ		0.028 BJ		0.034 QBJ		0.024 QBJ		0.031 BJ		0.029 QBJ		0.048 BJ
OCDD	N/A		0.013 BJ	0.015 BJ		0.013 BJ		0.014 BJ		0.020 BJ		0.014 BJ		0.019 BJ		0.014 BJ		0.022 BJ
2,3,7,8-TCDF	N/A		0.028 QJ	0.055 J		0.028 QJ		0.072 QJ		0.097 J		0.150 J		0.085 QJ		0.130 J		0.140 J
1,2,3,7,8-PeCDF	N/A		0.004	0.003		0.004		0.013 QJ		0.003		0.003		0.002		0.003		0.003
2,3,4,7,8-PeCDF	N/A		0.040	0.025		0.072 QBJ		0.039		0.025		0.027		0.021		0.024		0.029
1,2,3,4,7,8-HxCDF	N/A		0.013	0.010		0.046 QJ		0.037 QJ		0.010		0.013		0.008		0.008		0.009
1,2,3,6,7,8-HxCDF	N/A		0.013	0.009		0.013		0.013		0.011		0.013		0.008		0.008		0.035 QJ
2,3,4,6,7,8-HxCDF	N/A		0.012	0.009		0.011		0.049 QJ		0.010		0.012		0.008		0.009		0.011
1,2,3,7,8,9-HxCDF	N/A		0.014	0.011		0.013		0.072 J		0.013		0.014		0.009		0.010		0.011
1,2,3,4,6,7,8-HpCDF	N/A		0.012 QBJ	0.009 QBJ		0.008 QBJ		0.008 QBJ		0.009 BJ		0.006 QBJ		0.005 QBJ		0.001		0.010 BJ
1,2,3,4,7,8,9-HpCDF	N/A		0.002	0.002		0.002		0.002		0.002		0.002		0.002		0.001		0.002
OCDF	N/A		0.003 BJ	0.002 SBJ		0.003 BJ		0.001 QSBJ		0.001 QBJ		0.001 QBJ		0.001 SBJ		0.001 BJ		0.002 BJ
Total TEQ	N/A		0.63	0.47		0.74		0.80		0.75		0.62		0.83		0.76		0.64
<b>NORMALIZED DATA as TEQs per 1% Organic Carbon***</b>																		
2,3,7,8-TCDD	N/A		5.2	2.7		6.5		3.8		4.0		2.2		7.5		7.6		3.4
1,2,3,7,8-PeCDD	N/A		2.5	2.3		3.1		2.9		1.5		1.8		1.3		1.8		1.9
1,2,3,4,7,8-HxCDD	N/A		0.3	0.3		0.3		0.2		0.2		0.2		0.3		0.3		0.3
1,2,3,6,7,8-HxCDD	N/A		0.3	0.3		0.3		1.5		0.2		0.3		0.2		0.3		0.3
1,2,3,7,8,9-HxCDD	N/A		0.3	0.3		0.3		0.3		0.2		0.2		0.3		0.3		0.3
1,2,3,4,6,7,8-HpCDD	N/A		0.6	0.9		0.6		0.5		0.4		0.3		0.5		0.6		0.7
OCDD	N/A		0.3	0.3		0.3		0.3		0.2		0.2		0.3		0.4		0.4
2,3,7,8-TCDF	N/A		0.5	1.1		0.6		1.4		1.1		2.1		1.3		2.5		2.6
1,2,3,7,8-PeCDF	N/A		0.1	0.1		0.1		0.3		0.0		0.0		0.1		0.1		0.1
2,3,4,7,8-PeCDF	N/A		0.8	0.5		1.5		0.8		0.3		0.4		0.3		0.5		0.5
1,2,3,4,7,8-HxCDF	N/A		0.3	0.2		1.0		0.7		0.1		0.2		0.1		0.2		0.2
1,2,3,6,7,8-HxCDF	N/A		0.3	0.2		0.3		0.1		0.2		0.1		0.2		0.7		0.8
2,3,4,6,7,8-HxCDF	N/A		0.2	0.2		0.2		0.9		0.1		0.2		0.1		0.2		0.2
1,2,3,7,8,9-HxCDF	N/A		0.3	0.2		0.3		1.4		0.2		0.2		0.1		0.2		0.8
1,2,3,4,6,7,8-HpCDF	N/A		0.2	0.2		0.2		0.1		0.1		0.1		0.0		0.2		0.2
1,2,3,4,7,8,9-HpCDF	N/A		0.0	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0
OCDF	N/A		0.1	0.0		0.1		0.0		0.0		0.0		0.0		0.0		0.0
Total TEQ	N/A		12.1	9.8		15.4		8.7		8.5		12.4		14.9		12.1		13.6
																		8.9

Dup = Duplicate Sample

BDL = Below Detection Limits

\*mg/L

\*\* Texas Water Quality Standards for Saltwater

\*\*\* pg/g

B=Method Blank Contamination (associated method blank contains the target analyte at a reportable level), C=C0-eluting isomer, J=Estimated result since result was less than reporting limit,  
Q= Estimated maximum possible concentration, S=Ion suppression, X=See project narrative.

TABLE 4

CONCENTRATIONS OF DETECTED COMPOUNDS (ug/L)  
ELUTRIATE  
HSC - Carpenters Bayou to Greens Bayou

Date Sampled: October 30, 2012

Parameter	WQS**	Contract Required Detection Limit	Reporting Limit	H-MC-12				H-GC-12								H-G-12							
				Acute	Dup	11	11	01	02	03	04	05	06	Dup	01A	01	01B	02	02S				
Antimony	N/A	3	5.00	1.10	J	0.80	J	0.90	J	1.00	J	0.80	J	0.90	J	0.80	J	1.00	J	0.80	J		
Arsenic	149	1	5.00	4.80	J	3.90	J	4.00	J	8.30	J	5.20	J	4.40	J	4.60	J	6.80	2.50	J	4.80	J	
Chromium, Total	N/A	1	5.00	0.50	J	BDL	BDL	BDL	BDL	BDL	J	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		
Copper	13.5	1	5.00	1.50	J	1.50	J	1.30	J	0.70	J	0.60	J	0.60	J	0.70	J	0.50	J	0.80	J		
Lead	133	1	5.00	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		
Nickel	118	1	5.00	2.80	J	2.50	J	2.40	J	2.60	J	2.40	J	2.20	J	2.30	J	2.40	J	2.60	J		
Selenium	564	2	5.00	1.20	J	BDL	0.90	J	0.80	J	2.10	J	0.50	J	0.50	J	0.70	J	1.00	J	0.50	J	
Zinc	92.7	1	5.00	BDL	23.80	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Ammonia*	N/A	0.07	0.50	2.20		1.08		1.70		3.80		4.20		1.40		2.00		3.47		1.20		3.10	
TOC*	N/A	0.10	1.00	5.90		5.30		5.30		6.7		6.6		5.6		6.5		7.40		5.1		6.7	
Total Cyanide	N/A	0.10	1.00	5.6		5.6		6.0		4.0		5.0		5.2		7.7		6.4		7.1		6.2	
<b>UN-NORMALIZED DATA as TEQs</b>																							
2,3,7,8-TCDD	N/A		0.690 QJ	3.80 J	0.150 QJ	0.830 QJ	0.920 QJ	0.450	0.410 QJ	0.80		6.6 QJ	1.2	0.650	0.850	0.600	0.750						
1,2,3,7,8-PeCDD	N/A		0.120	0.370	0.370 QBJ	0.540 QBJ	0.120	0.280	0.120	0.55		0.160	0.550	0.390	0.390	0.320	0.420						
1,2,3,4,7,8-HxCDD	N/A		0.013	0.027	0.012	0.013	0.015	0.017	0.011	0.05		0.100 J	0.033	0.062 QJ	0.026	0.028	0.035						
1,2,3,6,7,8-HxCDD	N/A		0.097 QJ	0.031	0.070 QJ	0.055 QJ	0.096 J	0.018	0.012	0.05		0.230 J	0.034	0.034	0.100 QJ	0.031	0.039						
1,2,3,7,8,9-HxCDD	N/A		0.170 QJ	0.140 QJ	0.086 QJ	0.067 QJ	0.120 CJ	0.016	0.062 QJ	0.05		0.270 CJ	0.110 QJ	0.140 QJ	0.085 QJ	0.028	0.035						
1,2,3,4,6,7,8-HpCDD	N/A		0.310 BJ	0.280 J	0.150 BJ	0.150 BJ	0.210 BJ	0.034 QJ	0.079 BJ	0.26 J		0.730 B	0.270 J	0.240 J	0.087 QJ	0.066 J	0.059 J						
OCDD	N/A		0.270 B	0.170 B	0.160 B	0.120 B	0.170 B	0.025 BJ	0.057 B	0.18 B		0.630 B	0.180 B	0.170 B	0.051 B	0.027 BJ	0.030 BJ						
2,3,7,8-TCDF	N/A		0.290 J	0.650 J	0.110 QJ	0.120 QJ	0.068 QJ	0.040 QJ	0.083 QJ	0.13 QJ		1.500 X	0.770 J	0.360 J	0.210 QJ	0.045	0.055						
1,2,3,7,8-PeCDF	N/A		0.003	0.011	0.003	0.003	0.004	0.006	0.011 J	0.01		0.033 QJ	0.039 QJ	0.018 QJ	0.010	0.008	0.011						
2,3,4,7,8-PeCDF	N/A		0.110 QBJ	0.220 QJ	0.140 QBJ	0.140 BJ	0.031	0.057	0.024	0.12		0.048 QJ	0.100	0.170 QJ	0.100	0.075	0.093						
1,2,3,4,7,8-HxCDF	N/A		0.091 QJ	0.130 J	0.047 QJ	0.078 QJ	0.080 QJ	0.013	0.060 QJ	0.03		0.320 QJ	0.120 J	0.110 QJ	0.019	0.020	0.020						
1,2,3,6,7,8-HxCDF	N/A		0.080 QJ	0.020	0.050 QJ	0.079 QJ	0.088 QJ	0.012	0.065 J	0.03		0.350 QJ	0.120 QJ	0.100 QJ	0.021	0.020	0.020						
2,3,4,6,7,8-HxCDF	N/A		0.050 QJ	0.020	0.041 QJ	0.035 QJ	0.010	0.033 QJ	0.033 QJ	0.03		0.080 QJ	0.025	0.018	0.025	0.023	0.024						
1,2,3,7,8,9-HxCDF	N/A		0.010	0.025	0.011	0.038 QJ	0.011	0.013	0.010	0.04		0.012	0.065	0.024	0.020	0.024	0.023						
1,2,3,4,6,7,8-HpCDF	N/A		0.036 QBJ	0.072 J	0.024 BJ	0.032 QBJ	0.042 BJ	0.008 QJ	0.024 BJ	0.06 J		0.150 BJ	0.064 J	0.050 J	0.017 J	0.011 J	0.003						
1,2,3,4,7,8,9-HpCDF	N/A		0.002	0.020	0.002	0.002	0.002	0.002	0.002	0.01		0.018 BJ	0.007	0.004	0.004	0.004	0.004						
OCDF	N/A		0.012 SBJ	0.011 SJ	0.008 SBJ	0.008 SBJ	0.011 SBJ	0.002 J	0.005 BJ	0.01		0.036 SB	0.010 SJ	0.008 J	0.004 QJ	0.001 QSJ	0.001 QJ						
Total TEQ	N/A		2.3	6.0	1.4	2.3	2.0	1.0	1.1	2.4		11	3.6	2.5	2.0	1.3	1.6						
<b>NORMALIZED DATA as TEQs per 1% Organic Carbon</b>																							
2,3,7,8-TCDD	N/A		11.7	71.7	2.8	12.4	13.9	8.0	6.3	10.8		129.4	17.9	11.0	14.9	10.0	13.2						
1,2,3,7,8-PeCDD	N/A		2.0	7.0	7.0	8.1	1.8	5.0	1.8	7.4		3.1	8.2	6.6	6.8	5.3	7.4						
1,2,3,4,7,8-HxCDD	N/A		0.2	0.5	0.2	0.2	0.3	0.2	0.6	0.2		2.0	0.5	1.1	0.5	0.5	0.6						
1,2,3,6,7,8-HxCDD	N/A		1.6	0.6	1.3	0.8	1.5	0.3	0.2	0.7		4.5	0.5	0.6	1.8	0.5	0.7						
1,2,3,7,8,9-HxCDD	N/A		2.9	2.6	1.6	1.0	1.8	0.3	1.0	0.6		5.3	1.6	2.4	1.5	0.5	0.6						
1,2,3,4,6,7,8-HpCDD	N/A		5.3	5.3	2.8	2.2	3.2	0.6	1.2	3.5		14.3	4.0	4.1	1.5	1.1	1.0						
OCDD	N/A		4.6	3.2	3.0	1.8	2.6	0.4	0.9	2.4		12.4	2.7	2.9	0.9	0.5	0.5						
2,3,7,8-TCDF	N/A		4.9	12.3	2.1	1.8	1.0	0.7	1.3	1.8		29.4	11.5	6.1	3.7	0.8	1.0						
1,2,3,7,8-PeCDF	N/A		0.1	0.2	0.1	0.0	0.1	0.1	0.2	0.2		0.6	0.6	0.3	0.2	0.1	0.2						
2,3,4,7,8-PeCDF	N/A		1.9	4.2	2.6	2.1	0.5	1.0	0.4	1.6		0.9	1.5	2.9	1.8	1.3	1.6						
1,2,3,4,7,8-HxCDF	N/A		1.5	2.5	0.9	1.2	1.2	0.2	0.9	0.4		6.3	1.8	1.9	0.3	0.3	0.4						
1,2,3,6,7,8-HxCDF	N/A		1.4	0.4	0.9	1.2	1.3	0.2	1.0	0.4		6.9	1.8	1.7	0.4	0.3	0.4						
2,3,4,6,7,8-HxCDF	N/A		0.8	0.4	0.8	0.5	0.2	0.6	0.5	0.4		1.6	0.4	0.3	0.4	0.4	0.4						
1,2,3,7,8,9-HxCDF	N/A		0.2	0.5	0.2	0.6	0.2	0.2	0.2	0.5		0.2	1.0	0.4	0.4	0.4	0.4						
1,2,3,4,6,7,8-HpCDF	N/A		0.6	1.4	0.5	0.5	0.6	0.1	0.4	0.9		2.9	1.0	0.8	0.3	0.2	0.2						
1,2,3,4,7,8,9-HpCDF	N/A		0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1		0.4	0.1	0.1	0.1	0.1	0.1						
OCDF	N/A		0.2	0.2	0.2	0.1	0.2	0.0	0.1	0.7		0.1	0.1	0.1	0.1	0.0	0.0						
Total TEQ	N/A		39.0	113.2	26.4	34.3	30.3	17.9	16.9	32.4		215.7	53.7	42.4	35.1	21.7	28.1						

Dup = Duplicate Sample

BDL = Below Detection Limits

\* mg/L

\*\* Texas Water Quality Standards for Saltwater

B=Method Blank Contamination (associated method blank contains the target analyte at a reportable level), C=C0-eluting isomer, J=Estimated result since result was less than reporting limit,

Q= Estimated maximum possible concentration, S=Ion suppression, X=See project narrative.

TABLE 5

CONCENTRATIONS OF DETECTED COMPOUNDS (dry weight)  
SEDIMENT  
HSC - Carpenters Bayou to Greens Bayou

Date Sampled: October 30, 2012

Parameter	Units	Contract Required Detection Limit	NOAA ERM	NOAA ERL	H-MC-12			H-GC-12								H-G-12																	
					11	11 Dup	01	02	03	04	05	05 Dup	06	01A	01	01B	02	02S															
Antimony	mg/kg	2.5	N/A	N/A	0.39	J	BDL	J	BDL	J	0.426	J	0.434	J	0.369	J	0.431	J	0.499	J	0.241	J	0.386	J	0.542	J	0.609	J	0.29	J	0.413	J	
Arsenic	mg/kg	0.3	70	8.2	4.34	J	4.31	J	4.41	J	4.35	J	3.83	J	3.52	J	4.23	J	4.78	J	2.88	J	4.12	J	6.68	J	6.81	J	3.15	J	3.40	J	
Beryllium	mg/kg	1	N/A	N/A	0.893	J	0.969	J	0.948	J	0.945	J	0.839	J	0.794	J	0.886	J	1.03	J	0.528	J	0.839	J	1.15	J	0.973	J	0.673	J	0.805	J	
Cadmium	mg/kg	0.1	9.6	1.20	0.142	J	0.121	J	0.135	J	0.272	J	0.148	J	0.264	J	0.236	J	0.288	J	0.215	J	0.231	J	0.384	J	0.309	J	0.182	J	0.214	J	
Chromium, Total	mg/kg	1	370	81.0	15.6	J	16.9	J	17.0	J	18.1	J	15.8	J	15.3	J	18.4	J	21.6	J	11.3	J	18.3	J	23.4	J	22.2	J	12.4	J	16.1	J	
Chromium III	mg/kg	1	N/A	N/A	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J			
Copper	mg/kg	1	270	34.0	15.5	J	16.9	J	17.7	J	23.6	J	22.9	J	19.1	J	26.4	J	32.0	J	16.3	J	28.4	J	37.2	J	44.9	J	19.5	J	24.4	J	
Lead	mg/kg	0.3	218	46.7	14.4	J	13.9	J	14.4	J	18.8	J	15.9	J	16.5	J	20.0	J	23.0	J	13.4	J	20.5	J	25.6	J	27.5	J	13.6	J	18.1	J	
Mercury	mg/kg	0.2	0.71	0.15	0.098	J	0.085	J	0.11	J	0.174	J	0.152	J	0.122	J	0.190	J	0.166	J	0.154	J	0.132	J	0.150	J	0.151	J	0.066	J	0.054	J	
Nickel	mg/kg	0.5	51.6	20.9	11.1	J	10.7	J	10.2	J	11.9	J	10.4	J	8.89	J	10.8	J	12.3	J	6.29	J	9.93	J	13.1	J	11.7	J	8.00	J	9.61	J	
Selenium	mg/kg	0.5	N/A	N/A	0.736	J	0.623	J	0.775	J	0.577	J	0.677	J	0.275	J	0.708	J	0.619	J	0.255	J	0.581	J	0.473	J	0.573	J	0.334	J	0.262	J	
Silver	mg/kg	0.2	3.7	1.0	0.17	J	0.074	J	0.112	J	0.221	J	0.163	J	0.178	J	0.267	J	0.258	J	0.11	J	0.198	J	0.236	J	0.222	J	0.085	J	0.109	J	
Thallium	mg/kg	0.2	N/A	N/A	BDL	J	BDL	J	0.484	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J					
Zinc	mg/kg	2	410	150	67	J	60.8	J	63.9	J	91.3	J	75.2	J	71.5	J	90.7	J	106	J	57.5	J	89.4	J	130	J	121	J	73.1	J	88.8	J	
Acenaphthene	ug/kg	20	500	16	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Anthracene	ug/kg	20	1100	85.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo(a)anthracene	ug/kg	20	1600	261	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo(a)pyrene	ug/kg	20	1600	430	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	48.3	J	BDL	BDL	74.9	J	119	J	34.4	J	51.7	J			
benzo(b)fluoranthene	ug/kg	20	N/A	N/A	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	68.1	J	BDL	J	BDL	J	106	J	173	J	49.5	J	62.3	J	
benzo(g,h,i)perylene	ug/kg	20	N/A	N/A	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	
benzo(k)fluoranthene	ug/kg	20	N/A	N/A	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	
Chrysene	ug/kg	20	2800	384	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Fluoranthene	ug/kg	20	5100	600	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	55.6	J	BDL	BDL	183	J	502	J	41.4	J	56.6	J			
Fluorene	ug/kg	20	540	19	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Indeno(1,2,3-cd)pyrene	ug/kg	20	N/A	N/A	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	BDL	J	43.8	J	BDL	J	BDL	J	56.6	J	56.6	J	29.7	J	41.5	J	
Phenanthrene	ug/kg	20	1500	240	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	
Pyrene	ug/kg	20	2600	665	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	42.9	J	86.0	J	BDL	BDL	200	J	483	J	52.7	J	74.2	J		
Ammonia	mg/kg	0.1	N/A	N/A	25.7	J	29.7	J	39.4	J	49.5	J	55.1	J	21.5	J	43.2	J	35.0	J	11.2	J	24.8	J	48.6	J	29.8	J	29.7	J	29.4	J	
TOC	%	0.1	N/A	N/A	1.46	J	1.38	J	1.69	J	2.12	J	1.73	J	1.61	J	2.42	J	2.27	J	1.66	J	2.17	J	2.45	J	2.38	J	1.61	J	1.61	J	
Percent Solids	%	0.1	N/A	N/A	35.2	J	34.4	J	34.3	J	29.9	J	36.3	J	43.5	J	34.7	J	32.9	J	52.5	J	34.9	J	32.7	J	32.9	J	47.1	J	42.2	J	
Gravel	%	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3			
Sand	%	N/A	N/A	20.1	17.0	9.2	7.7	15.9	14.0	6.5	3.4	10.8	15.3	8.4	10.6	8.9	12.2																
Silt	%	N/A	N/A	10.1	8.7	13.1	20.4	12.2	9.4	16.7	34.1	9.4	9.9	16.2	18.8	41.2	28.2																
Clay	%	N/A	N/A	69.8	74.3	77.7	71.9	71.9	70.3	76.8	62.5	79.8	74.8	75.4	70.6	49.9	59.3																
D50	mm	N/A	N/A	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000			

TABLE 5  
 CONCENTRATIONS OF DETECTED COMPOUNDS (dry weight)  
 SEDIMENT  
 HSC - Carpenters Bayou to Greens Bayou  
 TABLE 3 (Concluded)

CONCENTRATIONS OF DETECTED COMPOUNDS (dry weight)  
 SEDIMENT  
 HSC - Carpenters Bayou to Greens Bayou

Date Sampled: October 30, 2012

Parameter	Units	Contract Required Detection Limit	Reporting Limit	NOAA ERL	H-MC-12				H-GC-12				H-G-12				
					11	11	01	02	03	04	05	06	Dup	01A	01	01B	02
<b>UN-NORMALIZED DATA as TEQs</b>																	
2,3,7,8-TCDD	pg/g	N/A	7.7	7.5	10	13	15	13	23	22	27	25	22	32	7.4	5.0	
1,2,3,7,8-PeCDD	pg/g	N/A	1.0 BJ	1.0 QBJ	1.1 QBJ	1.5 QBJ	1.3 QBJ	0.920 QBJ	1.5 QBJ	1.4 QBJ	1.7 QBJ	1.5 QBJ	1.7 BJ	1.6 BJ	1.2 QBJ	1.3 QBJ	
1,2,3,4,7,8-HxCDD	pg/g	N/A	0.180 J	0.170 QJ	0.230 J	0.270 J	0.260 J	0.220 J	0.240 J	0.310 J	0.220 J	0.240 J	0.270 J	0.420 J	0.210 J	0.160 J	
1,2,3,6,7,8-HxCDD	pg/g	N/A	0.350 J	0.370 J	0.470 J	0.570 J	0.560 J	0.550 J	0.610 J	0.770	0.630	0.600 J	0.750	0.920	0.510 J	0.490 J	
1,2,3,7,8,9-HxCDD	pg/g	N/A	0.690 C	0.710 C	0.910 C	0.900 C	0.930 C	0.810 C	0.660 CJ	0.910 C	0.590 C	0.750 C	0.890 C	1.6 C	0.540 CJ	0.500 J	
1,2,3,4,6,7,8-HpCDD	pg/g	N/A	1.2 BJ	1.300 B	1.5 B	1.9 B	1.8 B	1.5 B	1.4 B	2.4 B	1.5 B	1.7 B	2.1 BJ	3.2 BJ	1.4 B	1.3 B	
OCDD	pg/g	N/A	0.810 BJ	0.870 B	0.990 B	1.3 B	1.1 B	1.4 BE	0.600 B	1.5 B	0.870 B	1.1 B	1.4 BJ	1.5 BJ	1.6 BE	1.4 BE	
2,3,7,8-TCDF	pg/g	N/A	2.1 X	1.9 X	2.400 X	3.200 X	3.8 X	3.2	5.8	5.1 X	5.9	5.9	5.9	8.7	1.9	1.6	
1,2,3,7,8-PeCDF	pg/g	N/A	0.036 J	0.042 J	0.057 J	0.110 J	0.110 J	0.075 J	0.130 J	0.130 J	0.120 J	0.110 J	0.120 J	0.160 J	0.054 J	0.060 J	
2,3,4,7,8-PeCDF	pg/g	N/A	0.330 J	0.300 QJ	0.510 J	0.750 J	0.720 QJ	0.750 J	1.1 J	1.1 J	0.990 J	1.1 J	1.1 J	1.4 J	0.600 QJ	0.810 J	
1,2,3,4,7,8-HxCDF	pg/g	N/A	0.250 CJ	0.260 CJ	0.400 CJ	0.720 CJ	0.640 CJ	0.890 C	0.840 CJ	0.820 C	0.880 C	0.790 C	0.870 C	1.0 C	0.590 C	0.500 CJ	
1,2,3,6,7,8-HxCDF	pg/g	N/A	0.130 QJ	0.170 QJ	0.210 QJ	0.370 QJ	0.370 QJ	0.390 QJ	0.490 QJ	0.500 QJ	0.490 QJ	0.390 QJ	0.490 QJ	0.480 QJ	0.320 QJ	0.290 QJ	
2,3,4,6,7,8-HxCDF	pg/g	N/A	0.060 J	0.062 QJ	0.079 J	0.130 J	0.120 J	0.120 J	0.120 J	0.170 QJ	0.150 J	0.140 J	0.170 J	0.170 J	0.120 J	0.089 QJ	
1,2,3,7,8,9-HxCDF	pg/g	N/A	0.014 QJ	0.004	0.034 J	0.044 QJ	0.008	0.045 QJ	0.029 QJ	0.062 J	0.038 QJ	0.048 QJ	0.031 QJ	0.067 QJ	0.031 QJ	0.028 QJ	
1,2,3,4,6,7,8-HpCDF	pg/g	N/A	0.190 BJ	0.190 B	0.250 B	0.400 B	0.360 B	0.310 B	0.190 QB	0.480 B	0.280 B	0.360 B	0.320 QB	0.480 BJ	0.200 QB	0.190 QB	
1,2,3,4,7,8,9-HpCDF	pg/g	N/A	0.017 J	0.018 J	0.024 J	0.039 QJ	0.038 QJ	0.035 J	0.034 J	0.045 QJ	0.041 J	0.038 J	0.037 J	0.046 J	0.025 QJ	0.020 QJ	
OCDF	pg/g	N/A	0.072 BJ	0.063 B	0.099 B	0.180 B	0.140 B	0.099 B	0.063 B	0.093 B	0.072 B	0.110 B	0.075 B	0.110 B	0.033 B	0.023 B	
Total TEQ	pg/g	N/A	15	15	19	25	27	24	37	38	41	40	38	54	17	14	
<b>NORMALIZED DATA as TEQs per 1% Organic Carbon</b>																	
2,3,7,8-TCDD	pg/g	N/A	527	543	592	613	867	807	950	969	1627	1152	898	1345	460	311	
1,2,3,7,8-PeCDD	pg/g	N/A	68.5	72.5	65.1	70.8	75.1	57.1	62.0	61.7	102.4	69.1	69.4	67.2	74.5	80.7	
1,2,3,4,7,8-HxCDD	pg/g	N/A	12.3	12.3	13.6	12.7	15.0	13.7	9.9	13.7	13.3	11.1	11.0	17.6	13.0	9.9	
1,2,3,6,7,8-HxCDD	pg/g	N/A	24.0	26.8	27.8	26.9	32.4	34.2	25.2	33.9	38.0	27.6	30.6	38.7	31.7	30.4	
1,2,3,7,8,9-HxCDD	pg/g	N/A	47.3	51.4	53.8	42.5	53.8	50.3	27.3	40.1	35.5	34.6	36.3	67.2	33.5	31.1	
1,2,3,4,6,7,8-HpCDD	pg/g	N/A	82.2	94.2	88.8	89.6	104.0	93.2	57.9	105.7	90.4	78.3	85.7	134.5	87.0	80.7	
OCDD	pg/g	N/A	55.5	63.0	58.6	61.3	63.6	87.0	24.8	66.1	52.4	50.7	57.1	63.0	99.4	87.0	
2,3,7,8-TCDF	pg/g	N/A	143.8	137.7	142.0	150.9	219.7	198.8	239.7	224.7	355.4	271.9	240.8	365.5	118.0	99.4	
1,2,3,7,8-PeCDF	pg/g	N/A	2.5	3.0	3.4	5.2	6.4	4.7	5.4	5.7	7.2	5.1	4.9	6.7	3.4	3.7	
2,3,4,7,8-PeCDF	pg/g	N/A	22.6	21.7	30.2	35.4	41.6	46.6	45.5	48.5	59.6	50.7	44.9	58.8	37.3	50.3	
1,2,3,4,7,8-HxCDF	pg/g	N/A	17.1	18.8	23.7	34.0	37.0	55.3	34.7	36.1	53.0	36.4	35.5	42.0	36.6	31.1	
1,2,3,6,7,8-HxCDF	pg/g	N/A	8.9	12.3	12.4	17.5	21.4	24.2	20.2	22.0	29.5	18.0	20.0	20.2	19.9	18.0	
2,3,4,6,7,8-HxCDF	pg/g	N/A	4.1	4.5	4.7	6.1	6.9	7.5	5.0	7.5	9.0	6.5	6.9	7.1	7.5	5.5	
1,2,3,7,8,9-HxCDF	pg/g	N/A	1.0	0.3	2.0	2.1	0.5	2.8	1.2	2.7	2.3	2.2	1.3	2.8	1.9	1.7	
1,2,3,4,6,7,8-HpCDF	pg/g	N/A	13.0	13.8	14.8	18.9	20.8	19.3	7.9	21.1	16.9	16.6	13.1	20.2	12.4	11.8	
1,2,3,4,7,8,9-HpCDF	pg/g	N/A	1.2	1.3	1.4	1.8	2.2	2.2	1.4	2.0	2.5	1.8	1.5	1.9	1.6	1.2	
OCDF	pg/g	N/A	4.9	4.6	5.9	8.5	8.1	6.1	2.6	4.1	4.3	5.1	3.1	4.6	2.0	1.4	
Total TEQ	pg/g	N/A	1027	1087	1124	1179	1561	1491	1529	1674	2470	1843	1551	2269	1056	870	

Dup = Duplicate Sample

BDL = Below Detection Limit

B=Method Blank Contamination (associated method blank contains the target analyte at a reportable level), C=C0-eluting Isomer, J=Estimated result since result was less than reporting limit, Q= Estimated maximum possible concentration, S=ion suppression, X=See project narrative.

HOUSTON SHIP CHANNEL, TEXAS  
PIPELINE DREDGING  
EXXON TO CARPENTER'S BAYOU



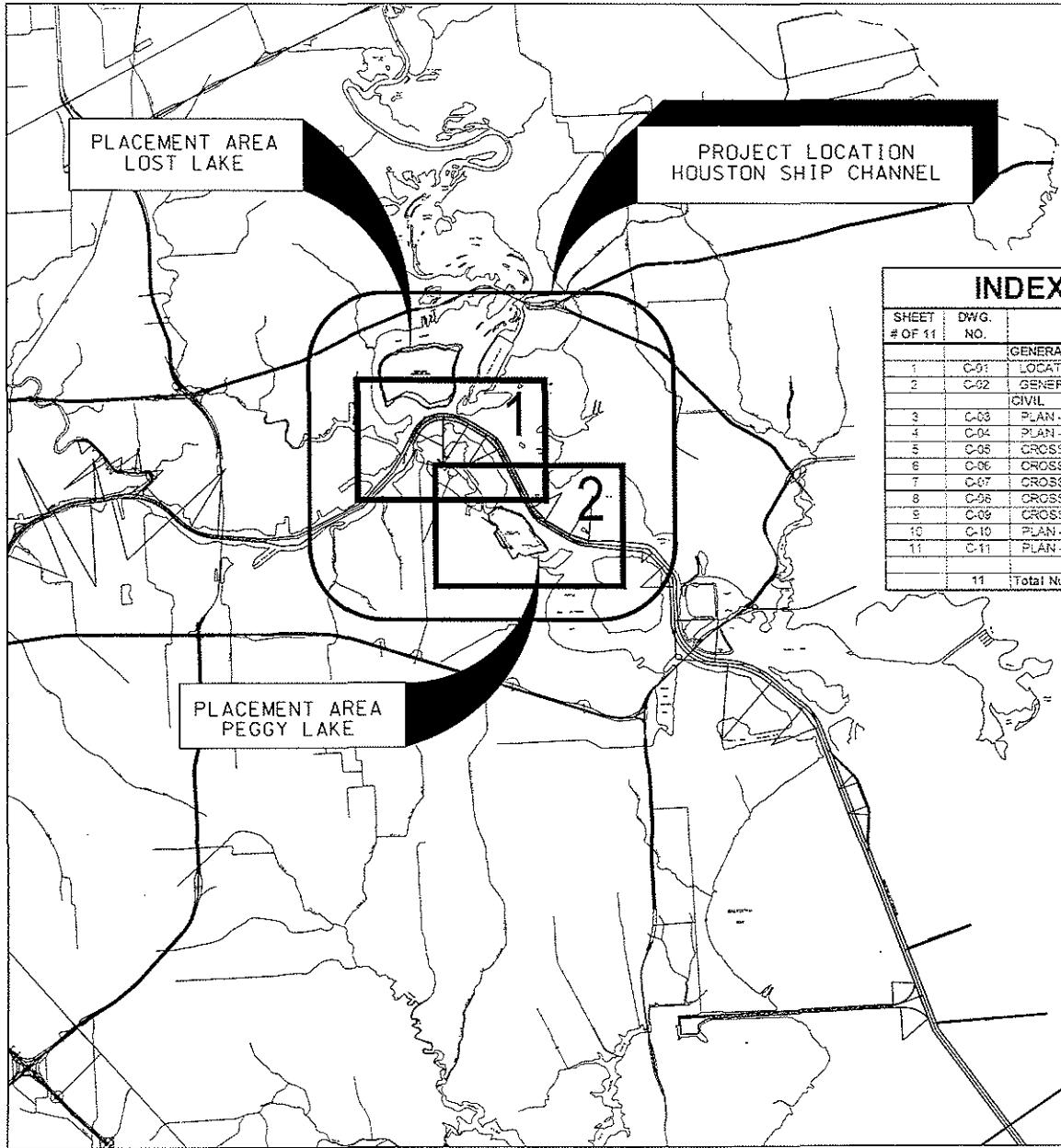
*Coastal Navigation and Environmental Restoration*

Office of the District Engineer  
U. S. Army Engineer District, Galveston  
Corps of Engineers  
Galveston, Texas  
July 2011

This project was designed by the Galveston District  
of the U.S. Army Corps of Engineers. The initials or  
signatures and registration designations of individuals  
appear on these project documents within the scope of  
their employment as required by ER 1110-1-3152.

SOLICITATION NO. W912HY-11-B-0015  
FILE NO. HSC 401-523





**PROJECT LOCATION**  
**HOUSTON SHIP CHANNEL**

N

INDEX OF DRAWINGS		
SHEET # OF 11	DWG. NO.	TITLE
		GENERAL
1	C-01	LOCATION PLAN AND INDEX OF DRAWINGS
2	C-02	GENERAL NOTES AND LEGEND
		CIVIL
3	C-03	PLAN - STA. 390+00 TO 520+00
4	C-04	PLAN - STA. 285+00 TO 390+00
5	C-05	CROSS SECTIONS - STA. 295+00 TO STA. 342+98.04
6	C-06	CROSS SECTIONS - STA. 350+00 TO STA. 400+00
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10	C-10	PLAN - LOST LAKE - PLACEMENT AREA
11	C-11	PLAN - PEGGY LAKE - PLACEMENT AREA
	11	Total Number of Drawings



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**HOUSTON SHIP CHANNEL, TEXAS  
PIPELINE DREDGING  
EXXON TO CARPENTER'S BAYOU**

**LOCATION PLAN  
AND INDEX OF DRAWINGS**

SOLICITATION NO.  
W912HY-11-B-0015



## Houston Ship Channel Alignment Data

Houston Ship Channel Alignment Data													
No	Type	Station	x=Easting	y=Northing	Radius Length	Delta (Deflection Angle)	Length of Curve (L)	Chord Direction	Chord Length (LC)	Tangent Angle (PC to PI) Circular	Tangent Distance (T) Circular	Tangent Angle Linear	Tangent Length (Linear)
PT		251+11.279	322664.244	13534282.20	3							N 85°44'3.32" W	4,224.515
Curve8	PC	299+35.793	3223807.71	13534698.08	4039.74	26°53.84' Right	1,859.127	N 72°Z11.40" W	1,623.285	N 85°44'3.32" W	935.762		
	PT	317+74.921	5222973.31	13536258.40	3							N 59°39'39.48" W	2,523.125
Curve7	PC	342+98.046	5215910.68	13538558.12	3139.58	32°36'49.50" Right	1,772.737	N 42°46'19.22" W	1,749.147	N 58°59'39.48" W	910.639		
	PT	360+70.783	3218722.88	13537842.10	0							N 28°32'55.97" W	5,964.233
Curve8	PC	420+40.013	3218054.79	13543181.86	3076.2	31°48'21.53" Left	1,705.885	N 42°26'59.64" W	1,684.091	N 26°32'55.97" W	875.483		
	PT	437+45.877	3214918.42	13544242.77	0							N 58°19'20.30" W	1,892.166
Curve8	PC	456+37.985	3213558.21	13545418.39	4304.681	31°38'55.11" Left	2,375.280	N 74°P47.883" W	2,345.271	N 58°19'20.30" W	1,213.726		
Curve10	PCC	480+13.276	3211052.93	13548509.72	2877	62°25'14.98" Left	2,916.455	S 68°E17.11" W	2,774.349	N 69°56'16.41" W	2,340.640		
	PT	509+29.730	3206677.94	13544634.89	0							S 27°38'29.62" W	2,215.957

## Horizontal Control

Station Name	Location	x=Easting	y=Northing	Latitude	Longitude	Elevation
Lynchesburg ID 517	San Jacinto Bay	3,212,558.95	13,846,804.80	29°45'54" N	95°04'41" W	3,371 (MLT)
L-4 Reset "A"		3,212,343.67	13,847,296.73	29°45'01".02" N	95°04'31".82" W	29,622 (MLT)
Ryan 2006		3,215,060.11	13,837,048.96	29°44'19".05" N	95°04'16".25" W	5,687 (MLT)
2069		3,215,967.48	13,855,757.01	29°44'06".97" N	95°04'06".47" W	14,484 (MLT)
2070		3,215,956.13	13,855,789.86	29°44'06".11" N	95°04'05".53" W	14,811 (MLT)

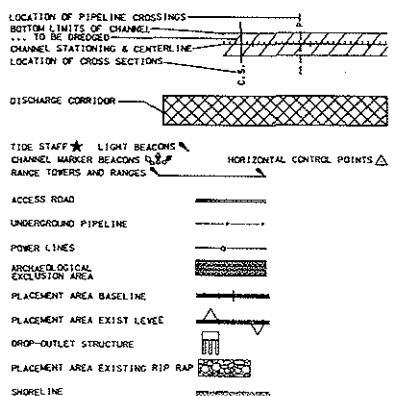
TIDE STAFF DATA

Channel	Number	Tide Staff Name	Easting/X NAD83	Northing/Y NAD83	Latitude	Longitude	MLT ft Below NGVD	Remarks
Houston Ship Channel	2	Morgans Point Staff	3,243,503	13,817,465	N 29°59'01.42"	W 94°45'55.72" W	1.36	
	3	Peggy Rear Range Staff	3,317,804	13,838,058	N 29°03'47.03"	W 94°42'28.15" W		
	4	Battleship Staff	3,208,655	13,842,724	N 29°05'26.98"	W 94°45'17.34" W		
	19	Green 133 Staff	3,201,041	13,836,384	N 29°05'55.48"	W 94°44'18.51" W		Dial Staff 1.36 & 1.14 Battleship

**GENERAL NOTES:**

1. HORIZONTAL COORDINATES ARE REFERENCED TO TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE NAD83.
  2. ELEVATIONS ARE REFERENCED TO COE MEAN LOW TIDE (MLL) DATUM.
  3. BEFORE AND AFTER DRILLING SURVEYS WILL BE TAKEN UTILIZING ELECTRONIC POSITIONING AND DEPTH EQUIPMENT. NO REFERENCE LINE WILL BE ESTABLISHED BY THE GOVERNMENT.
  4. ADDITIONAL CONTROL POINTS AND ALIGNMENT DATA (IF AVAILABLE) WILL BE FURNISHED TO THE CONTRACTOR UPON REQUEST IN WRITING.
  5. ALL CHANNEL END SLOPES SHALL BE EQUAL TO CHANNEL SIDE SLOPES AT THE SAME STATION.
  6. THE CONTRACTOR SHALL NOT CONDUCT ANY CONSTRUCTION ACTIVITY WITHIN THE EXCLUSION AREAS INCLUDING CLEARING, EXCAVATING, FILLING OR ANY TYPE OF VEHICULAR ACTIVITY.
  7. CONTRACTOR SHALL NOTIFY PIPELINE/UTILITY OWNERS 60 DAYS PRIOR TO ANY WORK OVER OR ADJACENT TO THE PIPELINE/UTILITY USING ONECALL OR ANY OTHER MEANS NECESSARY.

LEGEND



SOLICITATION NO.  
W912HY-11-B-001

HOU STON SHIP CHANNEL, TEXAS  
PIPELINE DREDGING  
EXXON TO CARPENTER'S BAYOU  
GENERAL NOTES AND LEGEND

C-02

Permit No.	C.D.B.A.C. 0001	Per.
Challenged by:	CHALLEGED BY: A.H.N.	JULY 2011
Comments:	SCAM, AS STATED IN CONTRACT. EXACTLY.	SCAM, AS STATED IN CONTRACT. EXACTLY.
Approved By:	PUBLIC WORKS B.C. BUREAU MANAGER/STAFF	DAVIDSON, R.A. CHIEF ENGINEER B.C. BUREAU

